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10/713,523	11/14/2003	Liang-Sheng Liao	87103RLO	9953

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EXAMINER

HINES, ANNE M

ART UNIT	PAPER NUMBER
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2879

DATE MAILED: 08/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/713,523	Applicant(s) LIAO ET AL. (pm)	
	Examiner Anne M. Hines	Art Unit 2879	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>11/14/03 & 7/20/05</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2, 3, 4, 5, 6, 7, 8, and 9 are rejected under 35 U.S.C. 102(e) as being anticipated by Ma et al. (US Pat. No. 6,916,554).

Regarding claim 1, Ma discloses an organic light-emitting device comprising: an anode (Fig. 1, 115); a hole-transporting layer (Fig. 1, 125) disposed over the anode; a light-emitting layer (Fig. 1, 135) disposed over the hole-transporting layer for producing light in response to hole-electron recombination, wherein the light-emitting layer includes at least one organic host material and one organic luminescent dopant material (Column 5, lines 24-27 and 34-39); a stability enhancing layer disposed in contact with the light-emitting layer (Fig. 1, 140), wherein the stability-enhancing layer includes at least one organic host material and one inorganic dopant material (Column 5, lines 47-56); an electron-transporting layer disposed over the stability enhancing layer (Fig. 1, 145); and a cathode disposed over the electron-transporting layer (Fig. 1, 160).

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Regarding claim 2, Ma further discloses the invention of claim 1 wherein the host material in the stability enhancing layer is selected from electron-transporting materials (Column 5, lines 47-56).

Regarding claim 3, Ma further discloses the invention of claim 2 wherein the ionization potential of the host material in the stability enhancing layer is equal to or less than the ionization potential of the host material in the light-emitting layer (Column 5, line 39; Column 5, lines 47-56). Wherein, since the host materials for the stability enhancing layer and the light-emitting layer may both be Alq_3 , the ionization potential of the host materials is inherently equal.

Regarding claims 4 and 5, Ma further discloses the invention of claim 2 wherein the host material in the stability enhancing layer includes metal complexes of 8-hydroxyquinoline, specifically tris(8-hydroxyquinoline)aluminum (Column 5, line 50). Wherein Alq_3 is tris(8-hydroxyquinoline)aluminum and inherently a metal complex of 8-hydroxyquinoline.

Regarding claim 6, Ma further discloses the invention of claim 1 wherein the inorganic dopant material in the stability-enhancing layer is a metal or metal compound (Column 5, lines 47-56).

Regarding claims 7, 8, and 9, Ma further discloses the invention of claim 6 wherein the dopant in the stability enhancing layer has a work-function lower than 4.0 eV; is an alkali metal, alkaline earth metal, or rare earth metal; and includes Li, Na, K, Rb, Cs, Mg, Ca, Sr, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, or

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Mn. (Column 5, lines 47-56). Wherein Li is an alkali metal and has a work function inherently lower than 4.0 eV.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 10, 11, 15, 16, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 36, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (US Pat. No. 6,916,554) and further in view of Leung et al. (US 2004/0124767 A1).

Regarding claims 10 and 11, Ma teaches the stability enhancing layer of claims 1 and 6 but fails to teach wherein the dopant in the stability enhancing layer has a work function equal to or higher than 4.0 eV. Ma also fails to teach wherein the dopant in the stability enhancing layer includes Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au. Leung teaches a stability enhancing layer (Page 1, Paragraph [0014]) wherein the dopant in the stability enhancing layer has a work function higher than 4.0 eV and wherein the stability enhancing layer includes Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au (Page 1, Paragraph [0016]; Page 10, Paragraph [0067]) in order to reduce the driving voltage and improve the stability and efficiency of the organic light emitting device (Page 1, Paragraph [0018], Paragraph [0067]). Leung teaches the dopant as a transition metal with a work function no higher than 4.5 eV, which to one of ordinary skill

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in the art includes the metals specified by claims 10 and 11. Therefore, it would have been obvious to one of ordinary skill in the art to modify the stability enhancing layer of Ma to include a dopant with a work function higher than 4.0 eV or to include Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au, as disclosed by Leung, in order to reduce the driving voltage and improve the stability and efficiency of the organic light emitting device.

Regarding claims 15 and 16, Ma fails to teach the organic light emitting device wherein the concentration of the dopant material in the stability enhancing layer is in the range of 0.1% to 30%, or 0.2% to 10% by volume. Leung teaches the concentration of the dopant material in the stability enhancing layer from 0.5% to 10% (Page 1, Paragraph [0016]), which is within the ranges specified in claims 15 and 16. As a matter of design engineering one skilled in the art would reasonably contemplate the desired concentration of dopant material, as evidenced by Leung, to be obvious over the prior art. Therefore, it would have been obvious to one of ordinary skill in the art to modify the stability enhancing layer of Ma to have a concentration of dopant material within the ranges specified in claims 15 and 16, as evidenced by Leung.

Regarding claim 22, Ma teaches an organic light-emitting device comprising: an anode; a hole-transporting layer disposed over the anode; a light-emitting layer disposed over the hole-transporting layer for producing light in response to hole-electron recombination, wherein the light-emitting layer includes at least one organic host material and one organic luminescent dopant material; a stability enhancing layer disposed in contact with the light-emitting layer, wherein the stability enhancing layer

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includes at least one organic host material and one inorganic dopant material; an electron transporting layer disposed over the stability enhancing layer; and a cathode disposed over the electron-transporting layer (See claim 1 rejection). Ma fails to teach wherein the electron-transporting layer includes host material or dopant material or dopant concentration that are different than the host material or dopant material or dopant concentration in the stability-enhancing layer. Leung teaches wherein the electron transporting layer (Page 10, Paragraph [0054]) includes host material or dopant material or dopant concentration that are different than the host material or dopant material or dopant concentration in the stability-enhancing layer (Page 10, Paragraph [0055]) in order to reduce the driving voltage and improve stability of the organic light emitting device (Page 1, Paragraph [0018]). Therefore it would have been obvious to one of ordinary skill in the art to modify making the electron transporting layer of Ma with a different host material or dopant material or dopant concentration than the stability-enhancing layer, as disclosed by Leung, in order to reduce the driving voltage and improve the stability of the organic light emitting device.

Regarding claim 23, Ma further discloses wherein the host material in the stability enhancing layer is selected from electron-transporting materials (Column 5, lines 47-56). Motivation to combine with Leung is the same as for claim 22.

Regarding claim 24, Ma further discloses wherein the ionization potential of the host material in the stability enhancing layer is equal to or less than the ionization potential of the host material in the light-emitting layer (Column 5, line 39; Column 5, lines 47-56). Wherein, since the host materials for the stability enhancing layer and the

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light-emitting layer may both be Alq₃, the ionization potential of the host materials is equal. Motivation to combine with Leung is the same as for claim 22.

Regarding claims 25 and 26, Ma further discloses wherein the host material in the stability enhancing layer includes metal complexes of 8-hydroxyquinoline, specifically tris(8-hydroxyquinoline)aluminum (Column 5, line 50). Wherein Alq₃ is tris(8-hydroxyquinoline)aluminum and inherently a metal complex of 8-hydroxyquinoline. Motivation to combine with Leung is the same as for claim 22.

Regarding claim 27, Ma further discloses wherein the inorganic dopant material in the stability-enhancing layer is a metal or metal compound (Column 5, lines 47-56). Motivation to combine with Leung is the same as for claim 22.

Regarding claims 28, 29, and 30, Ma further discloses wherein the dopant in the stability enhancing layer has a work-function lower than 4.0 eV; is an alkali metal, alkaline earth metal, or rare earth metal; and includes Li, Na, K, Rb, Cs, Mg, Ca, Sr, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, or Mn. (Column 5, lines 47-56). Wherein Li is an alkali metal and has a work function lower than 4.0 eV. Motivation to combine with Leung is the same as for claim 22.

Regarding claims 31 and 32, Ma fails to teach wherein the dopant in the stability enhancing layer has a work function equal to or higher than 4.0 eV. Ma also fails to teach wherein the dopant in the stability enhancing layer includes Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au. Leung teaches a stability enhancing layer (Page 1, Paragraph [0014]) wherein the dopant in the stability enhancing layer has a work function higher than 4.0 eV and wherein the stability enhancing layer includes Al, Ni,

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Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au (Page 1, Paragraph [0016]; Page 10, Paragraph [0067]) in order to reduce the driving voltage and improve the stability and efficiency of the organic light emitting device (Page 1, Paragraph [0018], Paragraph [0067]). Leung teaches the dopant as a transition metal with a work function no higher than 4.5 eV, which to one of ordinary skill in the art includes the metals specified by claims 31 and 32. Therefore, it would have been obvious to one of ordinary skill in the art to modify the stability enhancing layer of Ma to include a dopant with a work function higher than 4.0 eV or to include Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au, as disclosed by Leung, in order to reduce the driving voltage and improve the stability and efficiency of the organic light emitting device.

Regarding claims 36 and 37, Ma fails to teach the organic light emitting device wherein the concentration of the dopant material in the stability enhancing layer is in the range of 0.1% to 30%, or 0.2% to 10% by volume. Leung teaches the concentration of the dopant material in the stability enhancing layer from 0.5% to 10% (Page 1, Paragraph [0016]), which is within the ranges specified in claims 36 and 37. As a matter of design engineering one skilled in the art would reasonably contemplate the desired concentration of dopant material, as evidenced by Leung, to be obvious over the prior art. Therefore, it would have been obvious to one of ordinary skill in the art to modify the stability enhancing layer of Ma to have a concentration of dopant material within the ranges specified in claims 36 and 37, as evidenced by Leung.

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Claims 12, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (US Pat. No. 6,916,554) as applied to claims 1 and 6 above, and further in view of Tokito et al. (US Pat. No. 5,783,292).

Regarding claims 12, 13, and 14, Ma fails to teach the stability enhancing layer wherein the dopant includes the compounds of alkali metals, alkaline earth metals, or rare earth metals; wherein the dopant includes the compounds of Li, Na, K, Rb, Cs, Mg, Ca, Sr, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, or Mn; or wherein the dopant includes the compounds of Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au. Tokito teaches a stability enhancing layer wherein the dopant includes the compounds of alkali metals, alkaline earth metals, or rare earth metals; wherein the dopant includes the compounds of Li, Na, K, Rb, Cs, Mg, Ca, Sr, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, or Mn; or wherein the dopant includes the compounds of Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au (Fig. 3, 20; Column 9, lines 6-11) in order that the inorganic material does not degrade the properties of the organic material (Column 8, line 66 through Column 9, line 1). Therefore it would have been obvious to one of ordinary skill in the art to modify the stability enhancing layer of Ma to have a dopant material to includes the materials specified in claims 12-14, as disclosed by Tokito, in order to prevent degradation of the properties of the organic material by the inorganic material.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (US Pat. No. 6,916,554) as applied to claim 1 above, and further in view of Parthasarathy et al. (US Pat. No. 6,885,149).

Regarding claim 17, Ma fails to teach wherein the stability enhancing layer includes tris(8-hydroxyquinoline)aluminum doped with Li, Na, K, Rb, or Cs. Parthasarathy teaches the stability enhancing layer includes tris(8-hydroxyquinoline)aluminum doped with Li, Na, K, Rb, or Cs (Column 3, lines 50-57) in order to increase the efficiency of the organic light emitting device (Column 3, lines 50-57).

Claims 18, 19, 20, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (US Pat. No. 6,916,554) as applied to claim 1 above, and further in view of Hamada et al. (US Pat. No. 6,921,590).

Regarding claims 18 and 19, Ma teaches the invention of claim 1 but fails to teach wherein the thickness of the stability enhancing layer is in the range of from 2 nm to 100 nm or wherein the thickness of the stability enhancing layer is in the range of from 3 nm to 30 nm. Hamada teaches the stability enhancing layer (Fig. 1, 5) wherein the thickness is 10 nm (Column 7, line 63). As a matter of design engineering one skilled in the art would reasonably contemplate the desired thickness of the stability enhancing layer, as evidenced by Hamada, to be obvious over the prior art. Therefore it would have been obvious to one of ordinary skill in the art to modify the stability

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enhancing layer thickness to be within the ranges specified in claims 18 and 19, as evidenced by Hamada.

Regarding claims 20 and 21, Ma teaches the invention of claim 1 but fails to teach wherein the thickness of the light emitting layer is in the range of 5 nm to 45 nm or wherein the thickness of the light emitting layer is in the range of 5 nm to 30 nm. Hamada teaches the light emitting layer (Fig. 1, 4) wherein the thickness is 10 nm (Column 7, line 36). As a matter of design engineering one skilled in the art would reasonably contemplate the desired thickness of the light emitting layer, as evidenced by Hamada, to be obvious over the prior art. Therefore it would have been obvious to one of ordinary skill in the art to modify the light emitting layer thickness to be within the ranges specified in claims 20 and 21, as evidenced by Hamada.

Claims 33, 34, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (US Pat. No. 6,916,554) and Leung et al. (US 2004/0124767 A1) as applied to claims 22 and 27 above, and further in view of Tokito et al. (US Pat. No. 5,783,292).

Regarding claims 33, 34, and 35, Ma and Leung fail to teach the stability enhancing layer wherein the dopant includes the compounds of alkali metals, alkaline earth metals, or rare earth metals; wherein the dopant includes the compounds of Li, Na, K, Rb, Cs, Mg, Ca, Sr, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, or Mn; or wherein the dopant includes the compounds of Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au. Tokito teaches a stability enhancing layer wherein the dopant

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includes the compounds of alkali metals, alkaline earth metals, or rare earth metals; wherein the dopant includes the compounds of Li, Na, K, Rb, Cs, Mg, Ca, Sr, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, or Mn; or wherein the dopant includes the compounds of Al, Ni, Cu, Zn, Ga, Mo, Pd, Ag, In, Sn, Pt, or Au (Fig. 3, 20; Column 9, lines 6-11) in order that the inorganic material does not degrade the properties of the organic material (Column 8, line 66 through Column 9, line 1). Therefore it would have been obvious to one of ordinary skill in the art to modify the stability enhancing layer of Ma and Leung to have a dopant material to includes the materials specified in claims 33-35, as disclosed by Tokito, in order to prevent degradation of the properties of the organic material by the inorganic material.

Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (US Pat. No. 6,916,554) and Leung et al. (US 2004/0124767 A1) as applied to claim 22 above, and further in view of Parthasarathy et al. (US Pat. No. 6,885,149).

Regarding claim 38, Ma and Leung fail to teach wherein the stability enhancing layer includes tris(8-hydroxyquinoline)aluminum doped with Li, Na, K, Rb, or Cs. Parthasarathy teaches the stability enhancing layer includes tris(8-hydroxyquinoline)aluminum doped with Li, Na, K, Rb, or Cs (Column 3, lines 50-57) in order to increase the efficiency of the organic light emitting device (Column 3, lines 50-57).

Claims 39, 40, 41, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (US Pat. No. 6,916,554) and Leung et al. (US 2004/0124767 A1) as applied to claim 22 above, and further in view of Hamada et al. (US Pat. No. 6,921,590).

Regarding claims 39 and 40, Ma and Leung teaches fail to teach wherein the thickness of the stability enhancing layer is in the range of from 2 nm to 100 nm or wherein the thickness of the stability enhancing layer is in the range of from 3 nm to 30 nm. Hamada teaches the stability enhancing layer (Fig. 1, 5) wherein the thickness is 10 nm (Column 7, line 63). As a matter of design engineering one skilled in the art would reasonably contemplate the desired thickness of the stability enhancing layer, as evidenced by Hamada, to be obvious over the prior art. Therefore it would have been obvious to one of ordinary skill in the art to modify the stability enhancing layer thickness to be within the ranges specified in claims 39 and 40, as evidenced by Hamada.

Regarding claims 41 and 42, Ma and Leung fail to teach wherein the thickness of the light emitting layer is in the range of 5 nm to 45 nm or wherein the thickness of the light emitting layer is in the range of 5 nm to 30 nm. Hamada teaches the light emitting layer (Fig. 1, 4) wherein the thickness is 10 nm (Column 7, line 36). As a matter of design engineering one skilled in the art would reasonably contemplate the desired thickness of the light emitting layer, as evidenced by Hamada, to be obvious over the prior art. Therefore it would have been obvious to one of ordinary skill in the art to

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modify the light emitting layer thickness to be within the ranges specified in claims 41 and 42, as evidenced by Hamada.

Other Prior Art Cited

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

VanSlyke et al.	US Pat. No. 4,720,432	work function of metals
Forrest et al.	US 2003/0230980 A1	blocking layers
Sato et al.	US Pat. No. 6,660,411	

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anne M. Hines whose telephone number is (571) 272-2285. The examiner can normally be reached from 8:00-4:30 on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel can be reached on (571) 272-2457. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Anne M Hines
Patent Examiner
Art Unit 2879

*Auth
8/1/05*

Wm 8/2/05
MARICELI SANTIAGO
PRIMARY EXAMINER